NIF NEWS
THE NATIONAL IGNITION FACILITY NEWSLETTER

NIF Construction to Begin

Two key milestones have occurred to facilitate the start of construction on the National Ignition Facility (NIF)—the Department of Energy's Record of Decision last December to build the NIF at Lawrence Livermore National Laboratory (LLNL) and Critical Decision Three in March approving the start of construction, expected to begin in late May, 1997.

Record of Decision

The Department of Energy's (DOE's) Record of Decision to construct and operate the $1.2 billion NIF project at LLNL was announced by Secretary of Energy Hazel O'Leary on December 19, 1996. The decision was based on information and analysis contained in the Final Programmatic Environmental Impact Statement for the Stockpile Stewardship and Management Program, the DOE's plan for maintaining the safety and reliability of the nation's nuclear weapons stockpile. The decision completes the process required by the National Environmental Policy Act.

The Record of Decision also approved construction of the $50 million Contained Firing Facility at LLNL's Site 300 and the $43 million Atlas Facility, a pulsed-power experimental facility, at Los Alamos National Laboratory. These two new facilities, existing facilities, and the NIF will provide experimental data that, combined with unprecedented computer simulation power, will allow scientists to ensure the reliability and safety of the stockpile in the absence of nuclear weapons testing. This effort, the Stockpile Stewardship Management Program, is a response to the Comprehensive Test Ban Treaty, signed by President Clinton in September 1996.

> *"Our primary mission... is to use leading edge science and technology to assure the long-term viability of the nuclear stockpile. The NIF is fundamental to that strategy."*
> — *Bruce Tarter, Director, LLNL*

Critical Decision Three

The DOE's approval to start construction of the NIF at LLNL was announced March 7, 1997. This milestone, called Critical Decision Three, paved the way for groundbreaking as well as for signing construction and procurement contracts.

"The National Ignition Facility will make a fundamental contribution to our technical understanding of aging nuclear weapons," said Bruce Tarter, director of LLNL. "The hundreds of men and women who have carried us to this point are now ready to convert this critical scientific effort into concrete, steel, and lasers."

Full construction funding of the remaining $876.4 million has been asked for in DOE's FY1998 budget request, with $229.1 million of that to be spent in FY 1998. This approach is a departure from DOE's past practice of requesting partial funding year-by-year, which could result in schedule slippages and cost increases should Congress fail to provide the necessary funding each year.

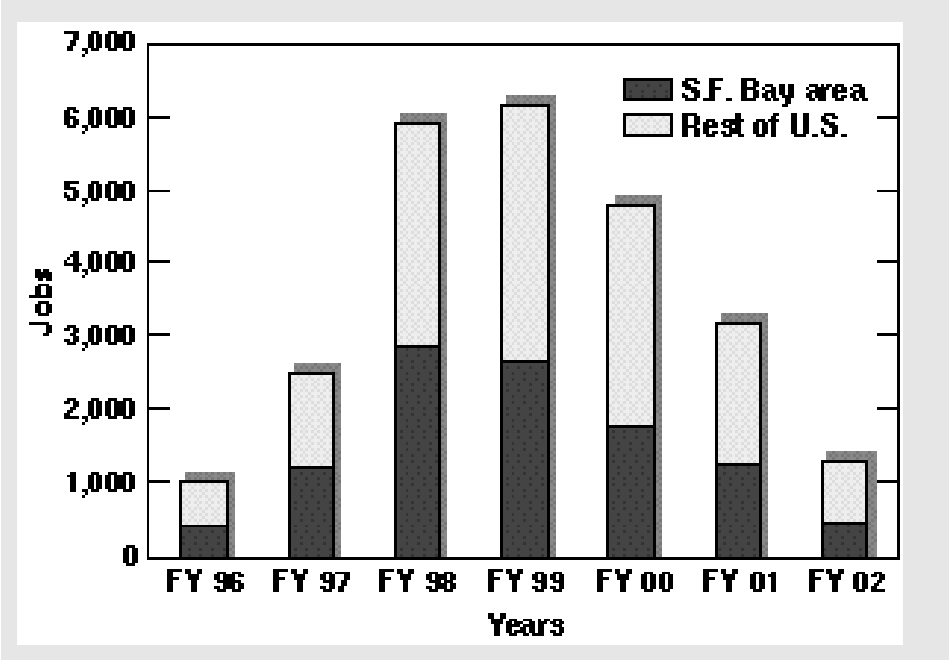
NIF Set to Ignite Economy

According to an independent study by Bay Area Economies, an urban development consulting firm in Berkeley, discoveries from the NIF and the inertial confinement fusion (ICF) program are likely to have significant impacts on U.S. industries in the next 10 to 15 years. Already, past innovations in ICF have led to commercial applications that may have important impacts on industries that represent $600 billion, or 10% of the U.S. gross domestic product, the study said.

The report estimates that over 6,000 jobs nationally and over 3,000 in the San Francisco Bay Area will be created by the NIF's construction. The report expects the jobs to be of high quality and to help retain U.S. competitiveness in high-technology fabrication firms.

The NIF will impact companies involved in precision optical products, integrated circuit manufacturing, computer controls, diagnostics, and advanced laser welding and cutting, among others.

Perhaps of even greater import, the report suggests that societal benefits may be even higher than the economic ones as a result of "spin-off" medical applications of ICF technology. While the impact of new automotive safety systems, medical diagnostic equipment, and improved telecommunications systems are hard to quantify, the report stated these could have significant impacts on the future quality of life and save many lives.



Additional employment created by NIF construction within and outside the S.F. Bay area.

Labor Pact Signed

A labor agreement between LLNL and the Building and Construction Trades Department, AFL-CIO, setting out wages and labor rules for the 6-year construction of the NIF was reached in January.

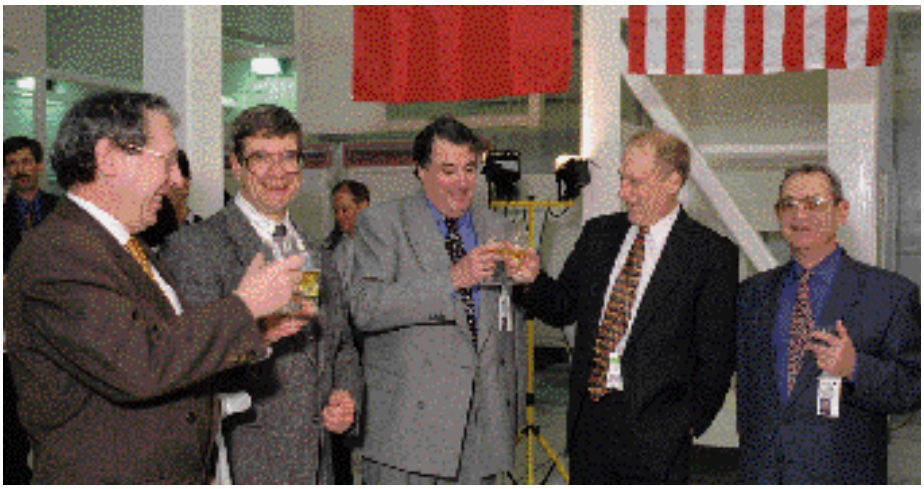
"Concluding a labor agreement before the start of construction is a win for everybody," said Mike Campbell, head of Laser Programs at Livermore. "It guarantees there will be no misunderstanding of the obligations of all parties in this extremely challenging and exciting project."

The labor agreement defines the portion of the project covered, how skilled construction labor will be obtained, what the terms and conditions of employment will be, how labor disputes will be settled, and other provisions. It does not, however, limit competition or the use of nonunion labor.

This is the first time LLNL or the University of California, which manages LLNL for DOE, has entered into this type of a blanket agreement, even though several other public projects have established the viability of such agreements and their benefits to the public.

French/U.S. NIF Collaboration Signed

A new laser beam amplifier, jointly designed by researchers at LLNL and in France, will be assembled and tested in a newly created laboratory at LLNL dedicated in a ceremony last January. The Amplifier Module Prototype Lab, or AMPLAB, complete with a "clean room" assembly area, was designed to produce a larger but more compact amplifier to be used both in the NIF and its French counterpart, the Laser Mega Joule, or LMJ. Because both France and the U.S. are commited to ending nuclear weapons testing and were building similar lasers, the collaboration was formed to save on costs and to share ideas.



At the AMPLAB dedication in January, Alain Delpuech (center) of France's Commisariat d'Energie Atomique (CEA), toasting DOE's Dave Crandall, is joined by (from left) Michel Andre, Project Manager for the LMJ; Howard Powell, LLNL Program Leader for Laser Science and Technology; and Pierre Veyrie, International Relations Manager for the CEA.

In a laser system, the amplifier builds up the power of a laser pulse from what is usually a weak source. While most laser amplifiers are designed to handle only one beam about 15 inches in size, this new design accommodates eight beams closely packed together. As a result, fewer amplifiers will be needed, and the laser bay can be smaller. The joint venture, therefore, has not only been economical in terms of sharing development costs, according to AMPLAB Group Leader Alvin Erlandson, but the design itself has reduced production costs.

The laser amplifiers store pulses of light from flashlamps in large slabs of laser glass until laser beams pass through them and extract the stored energy. The slabs transform the flashlamp pulses, which are emitted in bursts 360 millionths of a second long, to amplified laser pulses that are several billionths of a second long. These slabs must be completely clean to avoid particles from becoming superheated and causing damage to the surfaces. After assembly in the second-floor clean room, a specially designed crane lowers the slab through a floor opening into a robotic cart, a mobile clean room, which transports the slab to the amplifier for installation.

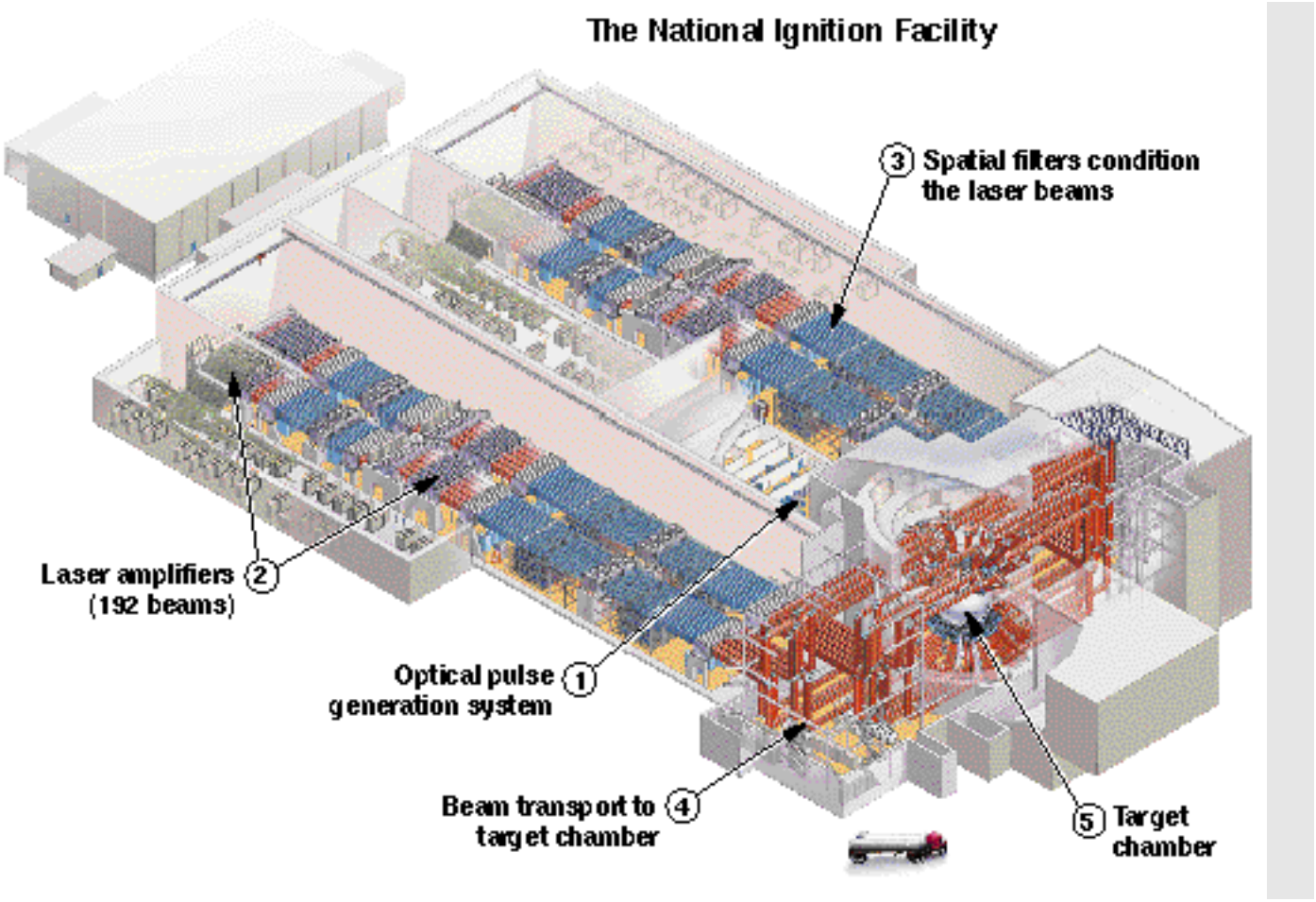
Beamlet Prototype Provides Answers

A full-scale prototype for one of the 192 beamlines of the NIF, called Beamlet, has been developed and used over the past three years as a testbed for optics and laser integration. It incorporates recent technology breakthroughs and material advances, such as high-damage-threshold coatings and crystal switches. Beamlet has already demonstrated the NIF single-beam requirements for energy, power density, harmonic conversion efficiency, and fluence. Its design is 20 times more compact than that of the Nova laser.

In September 1996, one of Beamlet's lenses was destroyed and another damaged during the highest-powered test to date, a 15-kilojoule, 20-nanosecond pulse. An investigation determined that the problem was the result of vibrations that occurred when the laser hit the lens, causing it to crack. It was concluded that the lens was too thin and vibrations tended to gather at the center of the round lens, increasing the intensity of the light to dangerous levels. As a result, new square lenses in which vibrations stretch out evenly were installed. In addition, the event initiated plans to set up the system so that the laser will not fire if a protective device is not operating properly.

Title I Design Complete

In December of 1996, the technical assessment of the preliminary (Title I) design of the overall NIF system was completed, gaining DOE approval to proceed to final (Title II) design. The Title I design integrated all major subsystems of the NIF including new cost and schedule projections. The completion of Title I also justified the release of resources to proceed with final engineering design details. The illustration below reflects the Title I design.



The heart of the National Ignition Facility (NIF) is a powerful laser whose energy will "ignite" small targets filled with fusion fuel. The NIF will (1) generate beams of laser light that are (2) amplified successively to greatly increase their energy, (3) conditioned to obtain the desired optical characteristics, and (4) transported through large beam tubes to a (5) target chamber, where the laser energy will compress and heat ICF targets to ignition.

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